Makira Forest Project
Madagascar

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MEF – IRG/PAGE – USAID

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Executive Summary

The International Resources Group (IRG) through a USAID-funded project and the Wildlife Conservation Society (WCS) have been working with Madagascar's Ministry of Water and Forests (MEF) to develop carbon financing options to aide the conservation of forests in northeastern Madagascar. The Makira Forest Project has been developed to meet this goal. The Project aims to achieve biodiversity and ecosystem conservation in a 4,600 km^2 Makira Forest Project Area (or "Makira Area") by promoting sustainable natural resource management and legal forest protection measures. The Makira Area contains 386,000 hectares of contiguous lowland and mid-altitude rainforest in northeastern Madagascar and may be one of the most important remaining biodiversity gems in the country.

A multidisciplinary team organized by IRG and MEF has investigated the Makira region, conducted background research and has proposed the Makira Forest Project Phase I to help achieve the related goals of conservation, economic development and carbon sequestration. This report presents initial findings and presents a preliminary project description.

Carbon Value of Makira

This study explored the use of carbon financing as one means to provide sustainable financing to the Makira Forest Project. The initial opportunity sought was the sale of carbon credits associated with the carbon stocked and CO_2 sequestered in the region's forests. Following recent Kyoto decisions there is no immediate market available for the sale of official carbon credits associated with the standing forests of Makira. However, there are at least three possible approaches for using carbon financing for the Makira Forest Project.

Three potential approaches are: 1) a reforestation project financed through the Clean Development Mechanism, 2) an off-market sale or donation by a company to benefit that company's public relations, and 3) future multinational, national or bilateral Greenhouse Gas (GHG) trading programs. The first option has been considered unfeasible due to the vast area of existing forests and the regional population's low levels of interest in reforestation activities. This option was discussed in a previous report[1] and is not discussed further in this report. The second option, an off-market sale, is clearly feasible based on the interest of corporations to manage their public relations in light of Greenhouse Gas concerns. The third, based on future options, has uncertain financial viability because of the early and undefined nature of these emerging markets but should be evaluated over the long term. The second and third options are discussed in this document. The second option is considered the most viable immediate source of funding for the Makira Forest Project.

[1] Meyers and Berner, 2001 Maroantsetra Carbon Project Progress Report

The Makira forests could contain up to 146 million tons of carbon stored in their biomass and soils. At a conversion rate of 3.67 tons of CO_2 equivalent to one ton of carbon, this would represent some 536 million tons of CO_2. The project will create a Core Conservation Area (or "Conservation Area") to assure long-term protection of this biomass and reduce carbon emissions primarily by decreasing deforestation. Through reducing deforestation we expect the project could successfully avoid the emission of 100,000 tons of carbon annually. These reduced emissions would annually offset the CO_2 emissions of 44 million gallons of gasoline used in US cars or 650 million kilowatt hours of electricity in the US.

With growing public concern for global warming, some large GHG intensive industries are taking a proactive stance regarding their emissions. This creates an opportunity for the Makira Forest Project to market its positive biodiversity and economic development impacts together with its carbon benefits to corporations seeking carbon offsets with strong public relations benefits.

The price for the carbon benefits in an off-market transaction is completely dependent on the willingness to pay of the corporation partner. Additionally, carbon financing is not expected to provide all the funding needs for the project. More traditional conservation funding will be needed to achieve the ambitious goals of the project.

Biodiversity of Makira

The species diversity and endemism levels of the Makira Area are expected to be among the highest in the country and, as a result, some of the highest in the world. Although few studies have been conducted in these forests, studies from some of the surrounding areas indicate that Makira could contain close to 50% of the species-level biodiversity of Madagascar. Considering that Madagascar may contain as much as 2% of global biodiversity, Makira, especially together with the nearby Masoala National Park could hold 1% of global biodiversity.

This extraordinary diversity and endemism of Makira is due in part to the extremely high plant biodiversity around the Antongil Bay and the presence in the Makira Area of 185,000 hectares of dense primary forest below 800 meters. The forests are likely to contain even higher levels of diversity than most other eastern rainforest sites because the region contains a variety of geological formations, diverse bioclimatic zones, and is part of one of the largest remaining contiguous areas of eastern rainforest. A full habitat and species inventory is proposed for the early stages of the project. This information will be essential for the creation of a new conservation area.

Makira Forest Project Phase I

The Makira Forest Project seeks "to become a leading catalyst for sustainable natural resource management and biodiversity conservation in the Makira Area." The proposed approach will include:
1) The study and the creation of a new legally protected Conservation or Protected Area that encompasses habitat and species diversity representative of the Makira Area and guarantees long-term connectivity to other networks of protected forests.

2) The identification and implementation of emerging mechanisms to empower local residents to control and manage their natural resources in a sustainable manner.

Other operational aims include:

a) The use of effective partnerships to implement the project vision with a minimal physical presence of the project.

b) The identification and implementation of innovative financing mechanisms to achieve sustainable financing for key project activities.

c) The promotion of private sector initiatives that will lead towards sustainable natural resource use.

The first phase of the Makira project aims to gather necessary information for the carbon, conservation, and development elements of the project and to secure long-term financing. The Project will create and assist with the protection of a new core conservation area and establish a surrounding multiple-use zone aimed at stabilizing land-use through natural resource management and economic development.

Project activities will be organized under the following 5 categories:

1) Market the carbon benefits to potential investors
2) Create and implement a carbon baseline and monitoring program
3) Create a legally protected Conservation Area
4) Promote sustainable natural resource management through land-use planning and targeted development activities
5) Establish a management structure for the Conservation Area

I. Background

Since 1990, the government of Madagascar has been engaged in implementing a long-term and comprehensive national environmental action plan, or NEAP. The driving factor that led to the preparation of the NEAP and its related investment programs was the recognized global significance of Madagascar's biological diversity. Numerous authoritative analyses over the past fifteen years have assigned Madagascar one of the world's highest priorities for biodiversity conservation. Madagascar's forests constitute the primary habitat for the country's unique biodiversity and are at the heart of these conservation efforts.

Madagascar is also characterized by extensive poverty, particularly in rural areas. Not surprisingly, there are limited public resources available for environment and conservation programs. The government has, to a degree, overcome its financial constraints with the support of the international donor community to implement the NEAP. The first phase of support, called the Environment Program 1 (EP1), was concluded in 1996. The current phase, the EP2, began in 1997 and is expected to end sometime around June 2002. The government has recently begun the planning and design work for the third, and final, five-year phase of the NEAP, for the period 2002-2007.

Within the context of designing the third environment program, or EP3, the government and the international community have placed considerable emphasis on the need to improve the sustainability of financing to ensure sound environmental management. The underlying hypothesis is that Madagascar must find means to diversify it's financing and increasingly internalize the costs of environmental activities. With respect to the forest sector in particular, there has been some progress in cost recovery and management of the national forestry fund. Yet, an enormous gap exists between the level of public resources available and those required to ensure effective forest management and conservation.

The Kyoto Protocol from 1997 sets greenhouse gas emission reduction targets for industrialized countries. To help achieve those objectives, the Protocol foresees the creation of various market mechanisms for achieving cost effective emissions reductions. The Clean Development Mechanism (CDM) is one of the aforementioned flexible mechanisms and it has the dual purpose of providing developing countries with the opportunity to implement sustainable development projects while providing industrialized countries a cost effective way to meet their commitments under the Kyoto Protocol. The CDM is the mechanism that can hold potential interest for a country like Madagascar. In essence, Madagascar has significant tracts of primary forests which stock carbon dioxide when they grow and release carbon dioxide when cut and burned – a practice locally know as "*Tavy*". Energy-intensive, petroleum, automobile, and other companies in the industrialized world are potentially interested in investing in the protection of these carbon stocks, i.e., in financing forest conservation, in developing countries to offset their CO_2 emissions. Identifying funding for growing forests or

avoided deforestation can increase the economic value of forest conservation and decrease the alarmingly high rate of deforestation.

The recent Marrakesh Decisions (November 2001) of the Conference of Parties to the Climate Change Convention have decided to only accept afforestation and reforestation as acceptable sources of carbon offset credits in the CDM during the first commitment period (2008-2012). This political decision has eliminated avoided deforestation from CDM financing regardless of the fact that it contributes as much as 25% of global GHG emissions. Although it is possible that avoided deforestation will be allowed in subsequent periods or as part of a future US-based program or other national programs, the future value of avoided deforestation-based carbon credits in developing countries (CDM eligible) has been largely decreased by the Marrakesh decision. Regardless of this administrative setback, there are many companies concerned with managing their public relations risks with regard to carbon emissions as much or more so than they are concerned with the future trading potential of the credits. In this report a distinction is made between carbon "credits" which are defined as tradable units recognized by national or international bodies and carbon "benefits" which are defined as the actual emissions reductions or carbon sequestration that can be attributed to a project. As the market develops and as the US enters the GHG reduction community, more options will develop for avoided deforestation.

Using an off-market transaction of carbon benefits by matching a company seeking to offset or reduce the impact of their carbon emissions with a large-scale conservation project is a win-win endeavor. It can help provide incremental financing for the Makira Forest Project and provide the company with strong environmental public relations benefits for its role in reducing greenhouse gas emissions and protecting threatened tropical forests in a manner that involves and directly benefits local communities.

II. The Makira Forest Project Overview

The Makira Forest Project aims to generate substantial biodiversity conservation and carbon sequestration benefits through the creation and funding of a new conservation area in Madagascar. The Makira Forest Project will help conserve one of the largest remaining forest tracts in the humid eastern rainforests of Madagascar. It will also create a permanent biodiversity corridor that helps to link Makira to a series of parks and reserves to the north. The future "Makira Conservation Area" will be the southern extension of the largest completely connected area of forest in Madagascar – effectively making it possible to walk from the east coast to the west coast over Madagascar's highest mountain – Tsaratanana – without leaving the forest.

Madagascar's Ministry of Water and Forests (MEF) currently holds primary management responsibility for the Makira forests since a large portion is included in the region's several Classified Forests. Unfortunately, the MEF has inadequate resources to effectively manage its vast forestland properties. The limitation on resources together with problems of inadequate legislation, agricultural pressure from an expanding population, and lack of regional natural resource planning, place the forests of Makira at massive risk of fragmentation and ultimate elimination. A rapid analysis of

the rate of forest loss in the region suggests that approximately 1500 hectares of primary forest is converted each year to agriculture and ultimately degraded hillsides. If the deforestation rate increases substantially – a likely outcome considering the rapid rate of human population growth – the entire forest – an area of more than 380,000 hectares will be lost within 100 years.

The International Resources Group (IRG) through the PAGE project and the Wildlife Conservation Society (WCS) have been assisting the Ministry of Water and Forests to develop financing options for the Makira Forest Project. Carbon financing has been identified as one funding source that could support classic conservation funding for the Project. As a result, a multidisciplinary team organized by IRG has investigated the region and has proposed a series of management actions to help achieve the related goals of conservation, economic development and carbon sequestration.

This report is divided into 2 main sections. The first section reports on the information gathered to date concerning the Makira Forest Project region. Information includes general land-use coverage of the region, estimation of carbon levels found in the standing forests, biodiversity found in or expected to be found in the area, and a preliminary socioeconomic description of the region. The second section proposes the organization, objectives and activities for the Makira Forest Project and includes a preliminary timeline and budget.

Project preparation activities conducted include:

Analysis of forest cover, forest conditions, and the evolution of forest cover change

- Two overflights with GPS and hand held photography
- Analysis of forest cover changes based on satellite images from 1990, 1996, and 2000 and aerial photography from the overflights.
- Creation of a precise land-use map based on inventories, satellite images, and overflight information and photos.
- Creation of multiple digital maps of the area overlain with forest cover, altitude, geology, soils, socioeconomic and administrative information.

Analysis of biomass and standing carbon based on existing data

- Analysis of above ground biomass and carbon levels at multiple sites in the eastern rainforests of Madagascar.
- Analysis of 1995 forestry inventories to determine estimates of total biomass and carbon storage levels in the Northeastern forests and in several sites in or adjacent to the Makira Area.

Review of existing information regarding the biodiversity value of the region

- Separate studies to accumulate and analyze existing knowledge concerning the fauna and flora of the region

Identification of potential institutional arrangements for the project

- Discussions with decision makers and economic actors in Antananarivo, the Toamasina Province, and the Maroantsetra region
- Working meetings with WCS, MEF, ANGAP, WWF, and Conservation International (as a potential Donor)

Main Findings

The initial land-use analysis confirms that the region is one of the most forested regions left in Madagascar with very high levels of dense primary forests even at altitudes below 800 meters. Of the total area of 460,000 hectares defined as the Project Study Area, a full 386,000 hectares or 84% is described as dense primary forest. Forest conversion is concentrated in the river valleys but is increasingly seen far up rivers. This appears to result from decreasing land availability for wet (or paddy) rice in the lowlands. With the population growing at over 3% annually, the current rate of deforestation (0.46%) can be expected to grow along with the population.

The carbon stocked in the Makira forests is relatively high as compared to other tropical forests. Data collected by the MEF in 1995 was used to estimate that Makira forests contain approximately 380 tons of carbon (tC) per hectare. Although somewhat lower levels are expected in degraded parcels, this standing biomass represents on the order of 146 million tons of carbon that is threatened by slash and burn agriculture.

There have been very few biodiversity inventories or studies in Makira. Based on published reports and expert opinion, the plants and animals of Makira are very likely to represent a significant portion of Madagascar's biodiversity. As a result of Madagascar being a Megadiversity Hot Spot country, Makira represents a significant share of global biodiversity as well.

Project Phase I

The first phase of the Makira project aims to gather necessary information for the carbon, conservation, and development elements of the project, create the legal and institutional framework and secure sustainable project financing. The overall approach will be to create a new legally protected core conservation area and establish a surrounding multiple-use zone aimed at stabilizing land-use through sustainable development with an emphasis on natural resource management. Thus, Phase I will lay the groundwork for achieving full economic, carbon and conservation benefits for the region.

The objectives and activities of the 2-year Phase I Project are relatively ambitious.

- **Market the carbon benefits to potential investors**
  1. Prepare a full dossier of materials reflecting existing relevant information concerning the investment
  2. Set up and conduct meetings with potential investors

3. Prepare a contract defining the transaction in collaboration with the Government of Madagascar (MEF and other appropriate government actors)
4. Negotiate and close investment deal

- **Creation and enactment of a complete carbon baseline and monitoring program**
  1. Determination of on-site baseline study and monitoring protocol
  2. Establishment of GIS database and remote sensing protocol
  3. Establishment of permanent sample plots and generation of baseline data
  4. Generation of baseline socioeconomic data
  5. Creation of model for predicting land-use changes and GHG emissions

- **Creation of a legally protected Conservation Area**
  1. Biodiversity Inventory of potential Conservation Area
  2. Determination and Preparation of Classification
  3. Promotion of government action

- **Promote land-use stabilization through land-use planning and targeted** development activities
  1. Creation of a regional natural resource management strategy and 10-year action plan
  2. Work with local decision-makers to establish local resource management plans
  3. Identify and test targeted development activities at key locations to minimize leakage and to increase overall project success
  4. Identify and support local development organizations

- **Establish Management Program for Conservation Area**
  1. Establishment of an initial Conservation Area management plan
  2. Create basic infrastructure for Conservation Area management
  3. Hire and train staff
  4. Establish communication program for local residents
  5. Facilitate legal enforcement through overflights and close partnerships with the MEF and other enforcement agencies

III.General Description of the Makira Forest Project Area

The Makira Forest Project seeks to implement activities within a large area of approximately 4,600 square kilometers in northeastern Madagascar. The area forms part of the Eastern Rainforest Biome of the country. This biome is known for its extremely high biological diversity and is to a large part responsible for Madagascar's status as a Megadiversity Hot Spot country. The project zone can be differentiated from most other areas of the eastern rainforest due to a combination of a unique geology and the impact of the Masoala Peninsula on the microclimate of the area. The mountainous Masoala (rising to 1311 meters) blocks some of the trade wind induced rainfall from reaching the Makira Area. This decreased rainfall level also combines with the large deposits of quartzites, sandstones and basalt as well as a small but unusual deposit of

marbles to generate several interesting bioclimatic zones (see Annex 6, Makira Flora Study). One result of these unique features is the presence, on the Makira plateau, of dwarf forests with trees not much higher than two meters. The area is also very dynamic with erosion on steep slopes quite common throughout certain areas of primary forests. The area is also prone to periodic cyclone activity especially in the northern section.

The forested zone of Makira has been divided up into several zones to facilitate evaluation of carbon, conservation and development issues.

Project Study Zone (PSZ)– The PSZ is the entire area that is being considered for action. On the west the limit is approximately the limit of the forest's edge, to the south the limit is the Rantabe River, to the east the limit follows the 740 km (Labord metric) longitude line up to the 1220 km latitude line then up the 760 km longitude line to the northern limit at 1250 km latitude. The total area of the Project Study Zone is 461,106 hectares or 4,611 square kilometers.

The PSZ is further divided into two parts:

Zone of Human Presence – This is the outer part of the "doughnut" that makes up the two parts of the Project Study Zone. Although there are significant tracts of primary forest within this zone, it contains almost all of the human settlements and towns in the PSZ. This zone will be the area of active intervention for development activities and will likely contain the limits to the Core Conservation Area.

Core Forest Zone – This is the "doughnut hole" or core area of undisturbed forest. It is a geometrically generated area (straight lines) that excludes almost all areas of *Tavy* and other forms of forest degradation. This zone is not a proposal for a protected area. It only defines an area that presently represents a non-disturbed state. Any future Conservation Area will most likely contain all of this zone but also considerable area within the Zone of Human Presence.

Figure 1. Regional Map

Figure 2. Map of Project Study Zone, Zone of Human Presence and Core Forest Zone

The following table provides estimates of different land uses in the Project Study Zone.

Table 1. Land Use and Forest Cover in the Project Study Zone – 1996 Satellite Interpretation

Project Study Zone	Below 800 m alt.	% <800 / PSZ	Over 800 m	% >800 / PSZ	Total	%
Dense Primary Forest	184703	40.06	201787	43.76	386490	83.82
Degraded Forest	27798	6.03	14543	3.15	42341	9.18
Savanna	706	0.15	8931	1.94	9637	2.09
Agriculture and rice paddies	2530	0.55	87	0.02	2617	0.57
Wetlands	1125	0.24	55	0.01	1180	0.26
Flood Plain	182	0.04	31	0.01	214	0.05
Obscured 1996	13942	3.02	4685	1.02	18628	4.04
Total	230986	50.09	230120	49.91	461106	100.00

Source: Neloni, Jean Clarck, 2001

As can be seen from the above table, over 386,000 hectares of dense primary forests cover almost 84% of the land in the Project Study Zone. Also evident is the fact that most of the agriculture, rice paddies and wetlands occur below 800 meters elevation. The lower elevations also contain almost twice the area of degraded forest than the higher elevations.

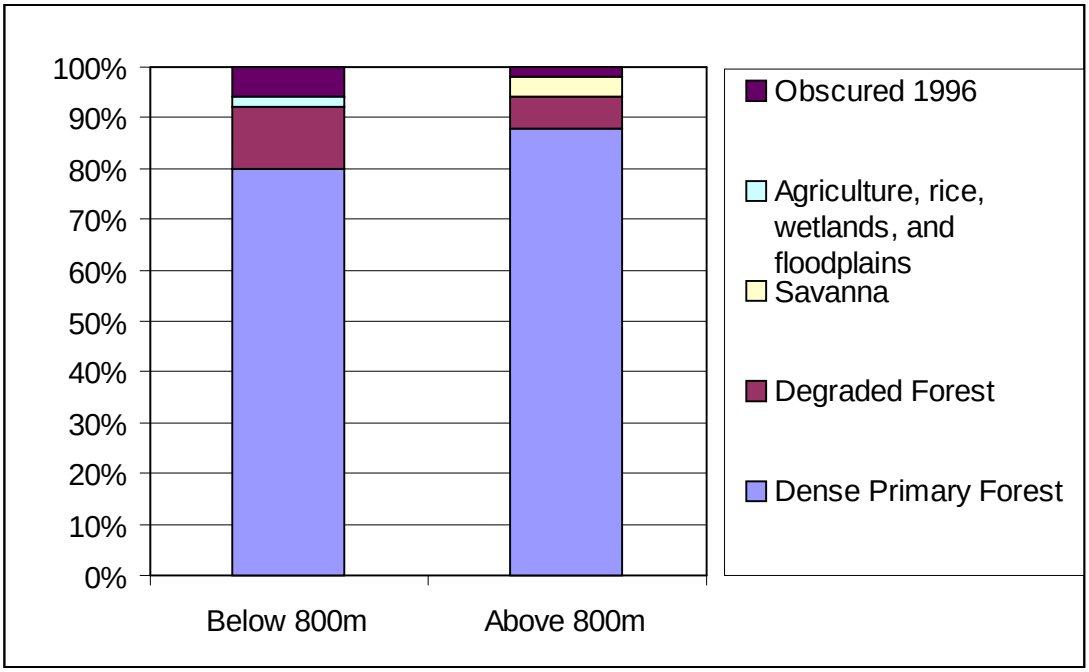


Figure 1. Comparison of land-use below and above 800 meters elevation in the Makira Project Study Zone.

Figure 4. Map of Land Use in the Makira Forest Project Area

Table 2. Comparison of land-use in the zone of human influence and the core forest zone (area in hectares)

	Zone of Human Influence	Core Forest Zone	Project Study Zone
Dense Primary Forest	231,880	154,610	386,490
% Primary Forest	77%	97%	84%
Degraded Forest	42,042	299	42,341
Savanna and Agriculture	12,212	42	12,253
Other	14,909	5,113	20,022
Total Area	301,043	160,063	461,106
% of PSZ	65%	35%	100%

The land use analysis presented above indicates the high quality of the forest of the area. Eighty-four percent (84%) of the study area's 461 thousand hectares were identified as dense primary forest. Almost half of the dense primary forest is found below 800 meters elevation (47.8%). Lower elevation forests in Madagascar are more severely threatened than higher elevation forests and tend to contain higher species-level diversity. The extremely high level of dense primary forest in the "Core Forest Zone" (97%) attests to the very high quality of that core area.

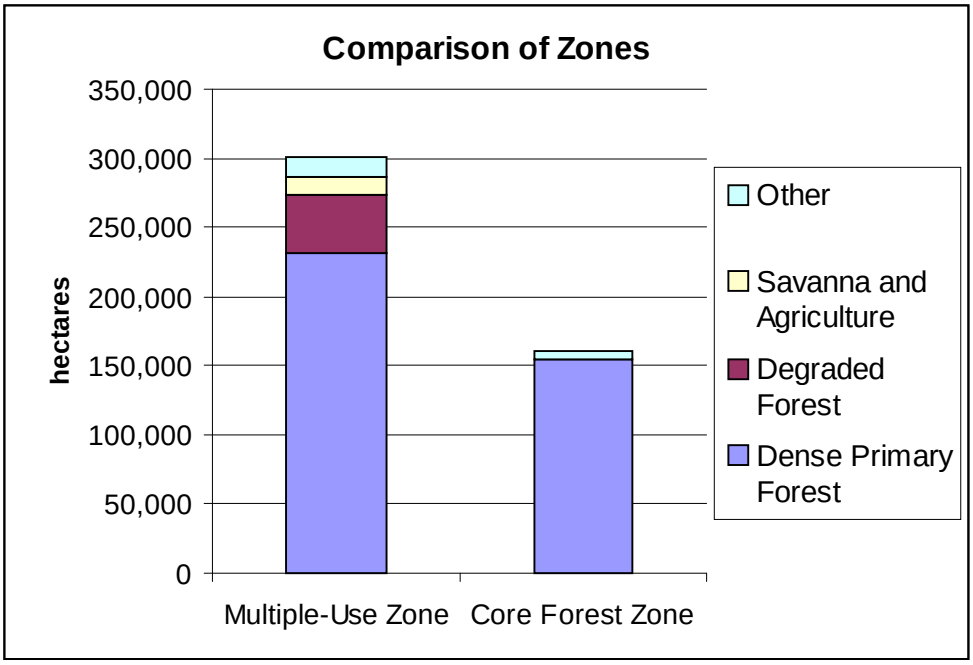


Figure 2. Area under different land-uses in the Human Influenced and Core Forest Zones.

It becomes obvious in Figure 2 that although the Core Forest Zone has a much higher relative amount of dense primary forest, the total area of dense primary forest is much greater in the Zone of Human Influence. As a result, the legally protected area of the Makira Project should include large areas within the Human Influence Zone as well as the Core Forest Zone.

IV. The Carbon Value of Makira

A. Carbon Benefits of Makira

The Makira Forest Project Area contains an enormous amount of standing carbon stocks. Its 386 thousand hectares of dense primary rainforest could stock on the order of 146 million tons of carbon, or 536 million tons of CO_2 (1 ton of carbon = 3.67 tons of CO_2). Current carbon market development indicates that no credit will be given for standing carbon – only changes to stocks or emission levels. However, the potential loss of this carbon stock through deforestation provides an opportunity to generate carbon credits and simultaneously assure the conservation of a very important tropical forest.

There are three approaches to capturing value from the carbon potential of the region. These are: 1) a reforestation project financed through the Clean Development Mechanism, 2) an off-market sale or donation by a company for that company's public relations benefit, and 3) future multinational, national or bilateral Greenhouse Gas (GHG) trading programs. The first option is considered unfeasible due to the vast area of existing forests and the regional population's low levels of interest in reforestation activities.[2] The second option, an off-market sale, is clearly feasible based on the interest of corporations to manage their public relations in light of the general public's increasing concerns about Greenhouse Gases and global warming. Although currently excluded from the Kyoto Protocol's CDM, avoided deforestation credits may become valuable under domestic or bilateral programs, currently under development and discussion. As these programs become established, these credits could become tradable and thus marketable. Furthermore, these credits could also enter the international market during the second commitment period of the Kyoto Protocol. Still, this third approach, future market options, has uncertain financial viability because of the early and undefined nature of these markets.

In this section, we evaluate the potential emission reductions that could be created by the project through avoided deforestation. Following this analysis, there is a discussion on the two later alternative financing approaches noted above.

The base assumption for generating carbon benefits is that through the creation of a conservation area and through development activities that are targeted to stabilize land-use, the deforestation rate will decrease. The area of forest saved from deforestation as a direct result of the project can be calculated, documented and eventually (if desirable) certified as avoided CO_2 emissions. Certification would only be desirable if a market for avoided deforestation credits emerges.

Three main elements are essential to determine the level of carbon emissions avoided:
1) The baseline level in current standing forests,
2) The amount of carbon released through conversion of forests to other land uses
3) The changes in human activity resulting from the project.

[2] Meyers and Berner, 2001 Maroantsetra Carbon Project Progress Report

These elements should be considered during project design regardless of the eventual certification of the emission reductions. Additional GHG-related factors will also play a role and should not be ignored for the monitoring plan. These include energy use and methane production from rice fields among others. For discussion purposes, we have assumed that through various activities, these related GHG will be change-neutral as a result of the project. This assumption is only preliminary and major additional GHG sources and sinks should be evaluated and monitored during the project. As well, additional carbon offset value could be generated by related development projects (improved stoves, hydro-power, new rice varieties.) These opportunities are beyond the scope of our current analysis but can be evaluated during the course of Phase I.

1) Baseline Carbon levels in Makira Forests

The preliminary biomass and carbon levels were estimated using data available from a 1995 national study of the conditions of Madagascar's Classified Forests (IEFN, 1995). These are preliminary estimations used for illustrative purposes and are inadequate for actual baseline documentation. Further work to quantify the emission reductions and emissions sequestered by the project is proposed during Phase I. A description of the data collection methods is briefly provided in annex 3 on Biomass Estimation[3]. Some results of the analysis are provided in the following table:

Table 3. Estimates of biomass and carbon pools in the forests around Makira, Northeastern Madagascar based on averages of 28 grouped samples divided among 6 base camps.

	Source	Extrapolation in % of above ground biomass	Total Volume (m3/ha)	Estimation of biomass (t/ha) 95% conf. int.	Quantity of C (t/ha) 95% conf. int.
Understory trees	IEFN		5.01	15.3 ± 2.21	7.67 ± 1.10
Trees >10cm DBH	IEFN		531	543. ± 63.0	272 ± 31.5
Palms	IEFN		5.75	0.642 ± 0.578	0.321 ± 0.289
Litter		7%		39.2 ±4.40	19.6 ± 2.20
Subtotal			*541*	*599 ± 67.3*	*299 ± 33.6*
Roots	P.M. FEARNSIDE[4]	17,5%		97.9 ± 11.0	49.0 ± 5.50
Soil[5]				140	70.0
Subtotal				238 ± 11.0	119 ± 5.50
Total				**837 ± 78.3**	**418 ± 39.2**

[3] Rakotomaro 2001a

[4] In Philip M. FEARNSIDE, 1992, Volume 2 : Greenhouse gas emission from deforestation in the Brazilian Amazon, Climate Change Division Environmental Protection Agency & Energy and Environment Lawrence Berkeley Laboratory, USA, 73p

[5] IPCC 1996 estimation of soil carbon for humid tropical soils with weak activity. We have chosen to use weak activity to be conservative. We note that some published rates suggest variability between 10% and 30% of the above ground biomass. That would suggest that the IPCC estimate of 70 tC/ha might be high for Makira. Actual figures could turn out to be as low as 30 tC/ha in which case it would lower the total mean to 378 ±39.2.

The 95 % confidence interval for carbon per hectare is 379 < x < 457. This is a relatively high level of carbon in comparison with other areas of tropical forests.

We have used the lower confidence estimate (~380 tC/ha) for demonstrative purposes in this project description. Actual sampling will be indispensable. Methods are described in annex 3 on Biomass Estimation[6]

2) Carbon Released through Conversion

The loss of carbon into the atmosphere following conversion of dense primary forest to alternative uses including *tavy*, agroforestry, other agricultural activities, and pasture can be very high. However, not all carbon is lost following forest conversion. The exact amount of carbon lost should be evaluated as part of the initial project activities. The establishment of the baseline model will include the use of direct measures and a literature search for comparable estimates. For the purposes of discussion we have assumed 50% of the carbon stored in the dense primary forest is lost eventually as a result of *tavy* – the primary form of forest conversion in the area.

3) Baseline vs. Project

An initial study of deforestation rates in the Makira Forest Project was undertaken by BIODEV with financial and technical support from IRG/PAGE. The main results of the study are presented in Table 4. More details are provided in annex 1 on deforestation rates.

Table 4. Deforestation Study Results 1990-1996[7]

	Area	Annual Deforestation Rate	Annual Forest Loss
Area Treated in Image	340,516 ha	0.43%	1505 ha
Project Study Zone:	232,561 ha	0.27%	644 ha
Zone of Human Influence	138,869 ha	0.45%	635 ha
Core Forest Zone	93,692 ha	0.01%	9 ha

Area Treated in Image – This is the total area available for deforestation analysis comparing the 1990 and 1996 Satellite images. It includes areas around Maroantsetra that are not part of the project zone. These areas included in the treated images that lie outside the Project Study Zone seem to have a similar rate of deforestation as the zone of human influence.

Project Study Zone (PSZ)– 232,561 of 461,106 hectares of the PSZ (50.4%) are included in the satellite images used for this analysis.

Zone of Human Influence –138,869 of 301,043 hectares (46%) are included.

Core Forest Zone – 93,692 of 160,063 hectares (58.5%) are included.

[6] Rakotomaro 2001a
[7] Clarck BIODEV 2001a

The stated deforestation rate in the PSZ is likely to be an underestimate of the current rate because 1) the dates are over 5 years in the past and 2) there is an area in the southeast obscured by clouds that is an active zone of deforestation as observed during the overflights in July and August 2001. An analysis that divided the PSZ treated in the deforestation study in four parts has shown that the area in the southeast had almost half the surface area covered in clouds. This area has a higher rate of deforestation than the current analysis suggests. Though it is not clear how much higher, a better estimate will be needed to establish an accurate baseline. Other high-quality satellite images of the project area have been identified and would be purchases for further analysis during the pilot phase.

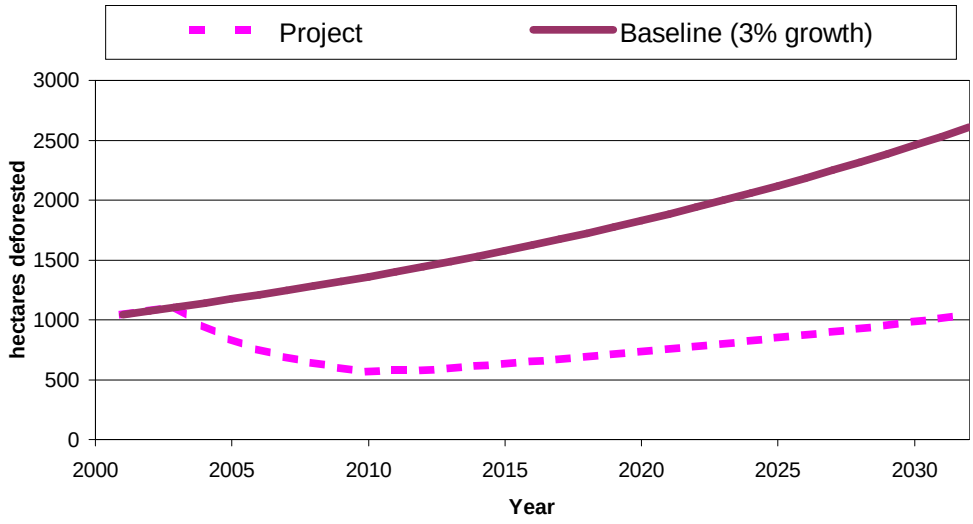
Figure 7 Map of Deforestation in 4 parts

The amount of avoided carbon emissions can be determined by comparing a baseline deforestation rate with the deforestation rate following the project. The baseline deforestation rate will be based not just on the current rate of deforestation but on a dynamic model that predicts changes in the major influences on deforestation. Such influences include population growth and economic development as well as natural resource use parameters. We suggest the use of a model such as a simplified version of the LUCF model of WRI (This software can be requested from World Resources Institute, wri.org)

The Makira Forest Project proposes to cut the deforestation rate for the PSZ in half by a combination of:
1) Establishing a pure Conservation Area (Protected Area) that is completely off limits to human occupation or use,
2) Active enforcement of new legislation in partnership with national and local law enforcement and Water and Forest Department officials and
3) Actively promoting the stabilization of land-use through various development and land-use planning activities.

The baseline deforestation rate can be expected to grow at nearly the rate of population growth – which is over 3%. If we assume a 3% annual increase in the rate of deforestation (from its current level of 0.45%) then the project seeks to have the following type of effect:

Figure 3. Projected deforestation level with and without (baseline) the project.



B. Leakage of Carbon Benefits

As stated above, there are three related elements to the project that will result in a decreased rate of deforestation: 1) legal classification of the conservation area, 2) enforcement of the new classification, and 3) targeted development activities aimed to stabilize land-use. There are numerous examples in Madagascar and elsewhere in the developing world of the impact of legislation coupled with enforcement as an effective

means to protect areas from deforestation. However, to gain carbon offset credit, the Project must prove that it has controlled what is termed "leakage." Leakage can be defined as the inadvertent emission of CO_2 as an externality to the project that is not accounted for by the project. One obvious example in this case is a farmer moving 5 km away from the project area and conducting deforestation activities there.

To avoid leakage issues and to increase the effectiveness of regional conservation, the project will attempt to internalize the potential externalities created by the project. This will be done by 1) directly seeking to solve a root cause of deforestation through sustainable development activities and 2) using an expansive definition of the project zone (about 460,000 ha as opposed to a core conservation zone of perhaps 250,000 ha). Both development activities and monitoring will occur in the larger area.

C. Carbon and Biodiversity

The goals of maximizing carbon retention and biodiversity retention are complementary in this project. For example, to minimize leakage, the project will need to not only help keep people from cutting in the protected area but also to account for those individuals and groups who would have cut the forest had the project not been there. Often people will simply move to a different area and cut the same amount. As a result, the same amount of carbon would have been emitted as before the project; the only change is its location. The addition of land-use stabilization as a complement to protection will result in the sound use and conservation of a larger area of forests. This will reduce leakage problems as well as provide a biodiversity benefit, help maintain long-term natural resource productivity, and keep open future sustainable development options.

D. Financial Value of Makira Carbon

The main financial value of the Makira Forests as carbon sinks is based on changes the project could accomplish against a baseline scenario. Specifically Makira Forest Project carbon benefits result from the avoidance of carbon dioxide emissions through reducing deforestation rates.

How much carbon could be offset by the project?

Our estimate of the carbon stored in one hectare of Makira's forests is on the order of 380 tC (lower confidence interval at 95% probability two-sided). Currently over the entire area of 461,106 hectares (386,000 ha of dense primary forest) we have conservatively estimated the annual deforestation rate to be about 0.27%. Almost all of this deforestation is occurring in the Zone of Human Influence which has a deforestation rate of 0.46% (See Table 4.) This Zone of Human Influence is losing a minimum of 1043 hectares of primary forest each year. If we assume that 50% of all the carbon pools are emitted in the several years following conversion, then about 200,000 tons of carbon are emitted into the atmosphere each year as a result of these activities. If the project could successfully avoid half of this emission of carbon (100,000 tC/year), it

would annually offset the CO_2 emissions of 44 million gallons of gasoline used in US cars or 650 million kilowatt hours of electricity in the US.

Cash Value of Makira Project Carbon

Both approaches to generating cash for the Makira Project's carbon benefits do not allow a direct financial valuation. The financial value of an off-market transaction will depend entirely on the value of the emission reductions to the corporate sponsor. A transaction that is based on the development of future markets for avoided deforestation credits will be heavily influenced by the investor's internal discount rate and by the time lag before these markets are fully active.

We propose the marketing of the carbon benefits as an off-market transaction in which the buyer receives written acknowledgement of their avoided emissions but in which no marketable official "carbon credit" is created or sold. In such a transaction, the corporate sponsor could claim anywhere from the 100,000 tC annually avoided up to the total volume of carbon stocked in the future protected area. Assuming a Core Conservation Area of about 250,000 hectares, there could be 95 million tons of carbon or 348 million tons of CO_2 equivalent stored in the forests.

Attempting to place a cash value on future market options for avoided deforestation credits is also problematic. The value of credits would be discounted by the fact that the market will not be available for several years (time value of money) as well as by the uncertainty surrounding the nature of the future market (risk factor). It is even possible that there will never be a market for avoided deforestation carbon credits although this seems highly unlikely. For this reason, no proposition is put forth at this time to determine a financial value for the carbon.

Future market options for Makira Forest Project carbon

Planning for a future market for avoided deforestation credits requires two main considerations to be addressed at this stage in the project development. These two main concerns are 1) the establishment of a clearly documented baseline and carbon monitoring protocol and 2) avoiding contractual obligations that limit future market options. It is suggested that the project document a baseline, establish a monitoring plan, and implement a monitoring program on the par with those required for the Kyoto Protocol's methodology concerning carbon sinks.

The project will establish an inventory and monitoring protocol that will allow the project to track the actual emission changes. This should be at a standard of quality to permit future accreditation of the carbon benefits of the project should the official market develop for avoided deforestation-based credits. A high quality program will greatly increase the chances of future market viability of these carbon benefits. The additional costs of accurate baseline establishment and monitoring must be balanced against the foreseen opportunity. Following the Kyoto Protocol's rules is a conservative approach because of the high likelihood that the future US system – or other national systems - will be less stringent.

Additional issues that will arise with the emergence of a viable market for avoided deforestation credits are ownership and responsibilities. The current approach to be used for Kyoto is that the seller is liable for the carbon. It is suggested that a similar approach be used here to increase the possibility of eventual market transactions in carbon offsets. If there is a problem generating the carbon offsets, it is the seller's responsibility to either compensate the buyer financially or by providing an alternative source of carbon offsets. Given this methodological approach, it appears that the owner (and seller) of the carbon credits should be the Government of Madagascar(GOM), via the MEF. In fact, should the future mechanism be the CDM (e.g. second commitment period) the GOM *must* approve any official carbon offset project. WCS should be taking responsibility together with MEF to assure the investors that the carbon emissions will be offset to the degree promised. Often it is recommended to decrease the contractual amount of carbon offsets offered for sale to 50% of what is projected. This avoids undo risk exposure to the seller and buyer. Because of the high risk of cyclones in the region, some type of cyclone insurance will be a valuable addition to any transaction.

WCS's role in marketing the carbon benefits is crucial. As a well respected International NGO, WCS can give the investor confidence that the sought after results will be attained. It is clear in this situation that WCS alone cannot produce the required results, but a partnership with MEF will be essential. WCS will work with the Madagascar Embassy in Washington DC to market future carbon credits. All primary contracts should be signed by both WCS and MEF to solidify the institutional responsibilities

Carbon funding is not expected to provide all the funding needs for the project. It is expected that more traditional conservation funding – especially in the early years of implementation – will be needed to achieve the ambitious goals of the project.

V. The Biodiversity Value of Makira

IRG PAGE and MEF have conducted a review of existing knowledge on the biodiversity of Makira. There are no complete inventories that have been conducted in the Project Study Zone. However, there have been intensive inventories conducted in some of the protected areas located to the north (Anjanaharibe-Sud), east (Masoala) and south (various). There have also been several short targeted studies in the Project Study Zone that focused on a few taxa.

Two teams of consultants – one for the flora and one for the fauna – conducted extensive literature reviews and surveyed experts who have worked in the region. The Ministry of Water and Forests commissioned this work conducted with the financial support of GEF. The research team that conducted the flora study was the Madagascar office of the Missouri Botanical Garden. The team that did the faunal report was the ZICOMA team created and supported by BirdLife International. The results of their findings are summarized here in two sections and the final reports are provided in the Appendices 5 and 6.

A. Flora of Makira

The floristic diversity and endemism of Makira is suggested to be very high. From comparisons with neighboring areas and through the investigation of several genera in the area, it is clear that the area will have very high specific and generic diversity. Forests to the east and south (Masoala and Zahamena respectively) have the highest species diversity compared with any other protected areas in Madagascar[8]. The extent of plant diversity can only be determined following botanical inventories.

A small area of the Project Study Zone has been studied briefly: the Classified Forest of Besariaka located in the northern part of the PSZ. The researcher - Ranorovelohanta - found 14 endemic species: 5 of which belong to endemic genera and 2 endemic families (Rhopalocarpaceae and Sarcolaenaceae). The following table summarizes the differences and similarities between Besariaka and two nearby Protected Areas.

	Number of species in common	% relative to the total number of plant species identified at Besariaka (82)
Btw Besariaka and Anjanaharibe-Sud	32	39 %
Btw Besariaka and Masoala	30	36.58 %
Common to all three forests	16	19.63 %

Although this study is preliminary, it does indicate the high degree of variation at the species level over relatively short distances. Besariaka is located directly south of Anjanaharibe-Sud but seems to only share about 40% of the same plant species. This could be in part due to a small sample size because the number of plant species known from a forest is related to the number of taxonomic specimens collected in the forest.

Botanical inventories and taxonomic studies will be conducted as part of the Phase I project. One main goal of the initial inventories will be the identification of different habitat types and forest stratification over the entire PSZ. Suggested details for inventories are described in annex 6.

[8] C. Birkinshaw et al., 2001 as cited in annex 6

Figure 9 Geological Map of Makira

B. Fauna of Makira

The fauna of Makira is likely as interesting – if not more - than the Makira's flora. This is due to the presence of a major biogeographical divider that cuts through the heart of the PSZ – the Antainambalana River. Although the complete importance of this river system is not well understood, it is know as a divider of several lemur subspecies. Lemurs are not able to swim and as such must cross the river at places where they can jump between trees on either bank. In the case of the Antainambalana, this narrow part of the river is an area located at an elevation of 2000 meters some 130 km northwest of the river's mouth in Maroantsetra. Although unlikely to act as a barrier for birds and flying insects, it is a possible biogeographical barrier for reptiles and some insects. The importance of this divider will be examined during the initial inventories. The report by ZICOMA (annex 7) is summarized in the sections below.

Primates

Although there are only 9 species recorded from one study at Makira, the study did not focus on primates and only collected data opportunistically. Given the comparisons and the known biogeography of lemurs in the northeast of Madagascar, it is possible that Makira contains as many as 15 different species of lemurs. This would be the highest diversity of lemurs found in any one reserve on the Island. It represents some 35% of total lemur species diversity. The reason for this high diversity is a combination of location as part of the Eastern Rainforest and the important biogeographical barrier described above. It is known that the barrier divides two subspecies of sifaka as well as the two subspecies of ruffed lemurs. The presence of these two sifaka (*Propithecus diadema diadema* and *Propithecus diadema candidus*) as well as the Indri and the black and white ruffed lemur (*Varecia variegata variegata*) complements the Masoala National Park that does not include these lemurs at all. Together the two reserves would likely contain nearly all Eastern Rainforest lemur species and an important percentage of the subspecific variation as well.

Carnivores

Seven carnivore species have been observed in the three nearest reserves. The scientists believe that all seven are likely to be found in Makira Project Study Zone. Five of the seven are considered vulnerable (IUCN Red Data Book). These seven species represent over 75% of the island-wide carnivore diversity.

Bats

There has been a short study of the bats of Makira. Eleven species have been found including one species not found in Masoala – one of the most intensively surveyed (for bats) forests in the northeast. This diversity represents about 1/3 of the island-wide bat diversity. Because the capture rate did not even out and because of biogeographical patterns the researchers (Bayliss and Hayes, 1999) suggest that the area could turn out to be the richest on the island for bat diversity.

Rodents and Tenrecs

Neither rodents nor tenrecs have been studied at Makira. Given the high diversity in the adjacent Anjanaharibe-Sud for both rodents (10 species) and tenrecs (16 species), it is likely that Makira will also show a very high diversity. Anjanaharibe-Sud, which should be relatively similar in diversity levels, represents about half of Madagascar's small mammal diversity. The importance of the Antainambalana as a barrier to gene flow and its related impact on distribution of these small mammals should be examined. The abundance of lower elevation forests bodes well for high levels of diversity. All the tenrecs are endemic to Madagascar and almost all the rodents are as well.

Birds

Only a peripheral study of birds has taken place in Makira. The literature search and observations of experts suggest that there are some relatively rare and endangered species of birds in the Makira Project Study Zone. At total of 124 species have been found in the parks and reserves in the northeast – suggesting that Makira will have similarly high diversity and endemism. This diversity represents about half of Madagascar's bird species. The richness of the regional avifauna can be attributed to the floristic diversity and the excellent state of natural habitats in the area. Similarly to what has been mentioned above for plants, the Antongil Bay area (which includes Makira and Masoala) is considered a center of diversity for birds because it has such a high level of endemism.

Reptiles and Amphibians

There have been several thorough studies of reptiles and amphibians in the area of the northeast although as with most other groups – Makira has not been examined. A total of 111 reptile species and 134 amphibians are described from the area. This represents an estimated 1/3 of reptiles and well over 50% of the amphibians of Madagascar. In fact, the area of "Masoala" as described in the complementary report (annex 7) is classified as one of the richest zones in Madagascar for herpetological diversity. Whether the Antainambalana River creates a dividing line for reptiles as it does for lemurs, will determine how different the southern part of Makira is from the species found in Masoala and Anjanaharibe-Sud.

Fresh Water Fish

Very little is known about the fresh water fish in the region of Makira. In the faunal report (annex 7), the two regional studies provided showed almost no overlap: only 3 species were in common out of 50 species total. For freshwater fish, two conservation issues predominate: 1) very high local endemism and 2) high degree of threat from invasive exotic introductions. Makira could be a haven for endemic fish in that there are extensive streams that retain their tree cover – a critical element protecting endemics against exotics. Studies will be required to identify the fish diversity, endemism and threat.

Arthropods

The area has been studied for moths and butterflies. There are 61 species of moths and butterflies recorded in these forests from a limited study (Lees, unpublished). The rest of the arthropod fauna remains to be studied. It is likely that ant diversity will be very high (167 species were found at Masoala) and they can provide an excellent indication of habitat diversity.

C. Biodiversity Conclusions

The biodiversity of the Makira plateau and the corridor up to Anjanaharibe-Sud is expected to be among the highest in the country. This is due in part to a combination of the following:

- The northeastern rainforests are known to contain some of the highest plant biodiversity in Madagascar – especially around the Antongil Bay
- The area contains high-quality forests along altitudinal gradients including an astounding 185,000 hectares of dense primary forest below 800 meters. Such forested gradients are increasingly being ruptured elsewhere in Madagascar and are of utmost importance for long-term conservation especially in light of global climate changes.
- The region contains a variety of geological formations including an impressive quartz intrusion at its center
- It is part of one of the largest contiguous areas of eastern rainforest left in Madagascar
- It contains diverse bioclimatic zones and microclimates that range from lowland rainforest, mid-altitude rainforest, and intrusions of azonal rainforest with short stature.

The major biodiversity issues that require investigation include:

- Species inventories in all groups to establish diversity and endemism patterns
- Habitat descriptions and inventories
- The importance of the Antainambalana River as a biogeographical barrier for all groups
- The relative importance of altitudinal and east-west (rainfall) gradients for species diversity and distribution patterns.

The location and distribution of centers of endemism and diversity will be critical for the planning of the conservation area limits and forming management plans for the entire area.

VI. Socioeconomic Situation

The socioeconomic situation of Makira is largely influenced by the following factors: a low level of transportation infrastructure, high numbers of farmers, low levels of education, and high population growth rates (est. 3.2%). The economy includes a

relative abundance of paddy rice in the lowlands and along river valleys and a relatively high degree of cash crop production on adjacent hillsides. It appears that slash and burn agriculture (*tavy*) is primarily practiced in the interior of the forested areas only when the lowland wet rice fields are fully exploited. Because most suitable lowland areas are currently being used, people seeking new rice fields travel far up the rivers either to establish new wet rice fields or to practice *tavy*.

In general, the lower part of a typical watershed contains anthropogenic landscapes with extended areas of paddy rice whereas the upper part contains primary forests. Along this land-pressure gradient:

- The lower part is characterized by heavily utilized agricultural land with little forest;
- The mid-slope is characterized by agricultural and agroforestry land in a forest mosaic and;
- The upper part as a *tavy* frontier in primary forest.

Activities in the lower part of the watershed trigger chain reactions through to the upper watershed, and vice versa. Fore example, land tenure, immigration, population increase, fuelwood supply, water management, and market access issues, are interrelated across the watershed.

The Project Study Zone contains or touches on the following “Communes” or counties:

Sous préfecture	Communes	Area (km²)
Maroantsetra	Voloina	500
Maroantsetra	Ambinanitelo	476
Maroantsetra	Anjanazana	230
Maroantsetra	Ankofa	150
Maroantsetra	Rantabe (small portion)	704
Befandriana-Avaratra	Bealampona	250
Befandriana-Avaratra	Ambodimanga	263
Befandriana-Avaratra	Tanandava	100
Befandriana-Avaratra	Antsahamena	250
Andapa	Antsakabary (small portion)	1144
Andapa	Matsondakana	1650

The region is relatively poor in comparison to other parts of Madagascar although a recent boom in clove prices brought a slight boost to the regional economy. Unlike cloves and in part, vanilla, most of the cash crops are commodities that are heavily represented throughout the tropics. Primary cash crops include:

- Sugar cane
- Coffee
- Vanilla
- Cloves
- Peppercorns

Subsistence agriculture is dominated by rice with a relatively high amount of cassava and a small amount of corn being planted to complement the rice. Although there are

vast areas of paddy rice, especially around the Maroantsetra flood plain, the region is a net importer of rice.

The ethnic groups of the region consist primarily of Betsimisaraka (70%) who are original inhabitants of eastern Madagascar. There has been migration into the region from other ethnic groups including the Tsimihety (25%), Betsileo (1%), and other groups from the southeast (1%) and elsewhere (3%). The degree of cooperation among different ethnic groups and even within certain communities has been brought into question by several studies in the area.[9] The studies suggest that there may be higher than usual difficulties forming agricultural cooperatives and other economic associations. Although the reason for this remains unclear, it should be considered during the formulation of Phase I project activities.

The Antongil Bay itself has several implications for the economic development of the region. First, the port of Maroantsetra sees a moderate degree of boat traffic capable of transporting cash crops to Toamasina (the main international port) for export or for sale in the Capital. Secondly, the development of the fisheries remains an important potential regional opportunity for alternative employment.

There are several development projects being conducted in the region however they currently focus on Maroantsetra or the peripheral zone of Masoala.

VII. Makira Forest Project

A. General Project Description and Vision

The Makira Forest Project has the following vision: "to become a leading catalyst for sustainable natural resource management and biodiversity conservation in the Makira Area." The approach to be used includes:
1) The study and the creation of a new legally protected Conservation or Protected Area that encompasses habitat and species diversity representative of the Makira Area and guarantees long-term connectivity to other networks of protected forests.
2) Identify and facilitate emerging mechanisms to empower local residents to control and manage their natural resources in a sustainable manner.

Other operational aims include:

a) The use of effective partnerships to implement the project vision with a minimal physical presence of the project.
b) The identification and implementation of innovative financing mechanisms to achieve sustainable financing for key project activities.
c) The promotion of private sector initiatives that will lead towards sustainable natural resource use.

[9] Lou Brown, PhD Thesis on Betsimisaraka at Masoala and Eva Keller pers. Comm.

Currently we envision two main intervention zones: A Core Conservation Area surrounded by a Sustainable Natural Resource Management Area. The two areas together comprise the Makira Forest Project Area.

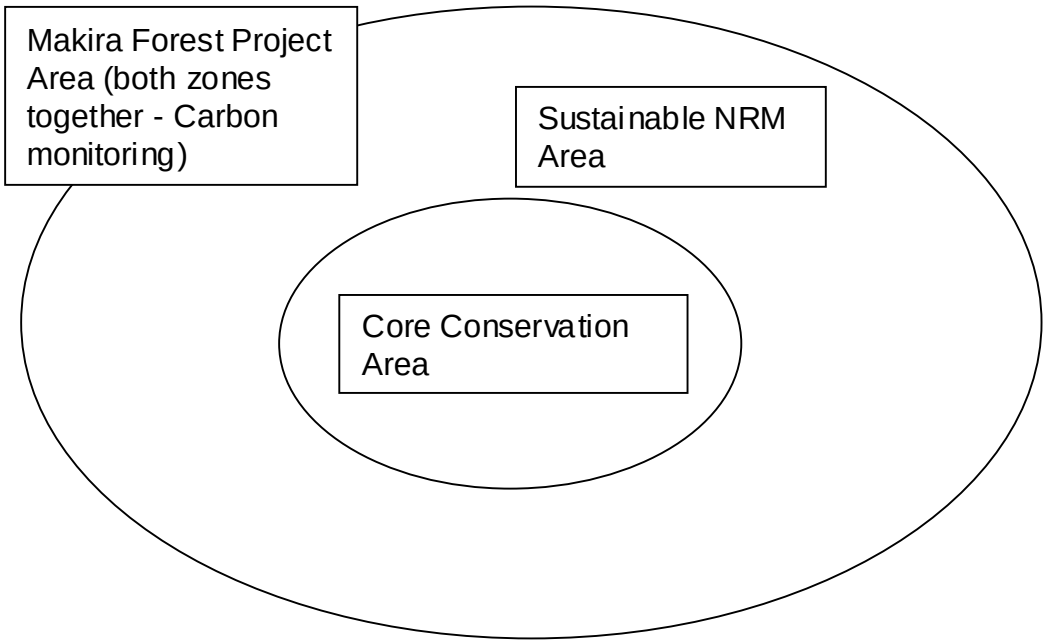


Figure 4. Schematic Model for Zoning of the Makira Forest Area

The Core Conservation Area will likely be classified as a Type II or a Type IV IUCN protected area. The aim will be to protect the ecosystem and biodiversity for future generations. The Sustainable Natural Resource Management (SNRM) area will either remain unclassified or may be classified as a Type VI IUCN protected area – this is more along the lines of a multiple use area with biodiversity being only one element of the management strategy. Other elements could include sustaining cultural practices and resource use. The determination of the classification status and limitations will take place early in the project life. The Malagasy Protected Areas legislation (COAP) will be useful for the classification of both the core area and perhaps some of the Human Influence Zone.

B. Current Institutional Situation

The project structure as currently envisioned involves a close partnership between the Madagascar's Ministry of Water and Forests (MEF) and the Wildlife Conservation Society (WCS) headquartered in New York with offices in Antananarivo and Maroantsetra. WCS would be the implementing organization under the authority of the MEF and potentially ANGAP. The MEF would sit on any steering committees and would have active responsibility for certain project aspects – especially with regard to forestry, legislation, and enforcement. WCS would be responsible for overall project management, biodiversity inventories, any delimitation studies, identifying and engaging with local and regional implementation partners, and fundraising. ANGAP could be an additional partner if the classification of the Core Conservation Area falls under the

National System of Protected Areas. WCS would be the sole marketer of the carbon offsets or benefits representing the GOM through the MEF.

Details of the organizational arrangements have not been finalized. Discussions with the MEF have outlined the following scenario:

The Ministry of Water and Forests (MEF) acting as lead institution will be part of a contract that would involve three players: MEF, the Investor and WCS. WCS would play the role of assuring the activities on the ground and MEF would play the role of assuring adequacy of legislative and enforcement measures. Additionally, several "Accord de Principe" (similar to a Memorandum of Understanding) will be required between the MEF and the Autonomous Provinces of Toamasina and Antsiranana as well as between MEF (or WCS as agent to MEF) and several "Comité d'Orientation" which serve to help direct activities on the ground. These committees would include local government representatives and local partners. Depending upon the nature of the classification of the Core Conservation Area, ANGAP could play a major role in the organization and operation of the project.

The relation between MEF and the Provinces has yet to be worked out but the fact that the Makira Area includes forests in two provinces provides a strong argument for central management (MEF) as opposed to the creation of two distinct projects or protected areas.

One major gap in the institutional structure for the project is the lack of a compatible on-the-ground rural development organization. Potential candidates include CARE who has a limited presence in the area and ANAE who have recently begun some project activities in the region, among others. One outcome of the project will be to develop local capacity to provide rural development services.

An informal committee led by MEF and WCS has met once and will continue to meet on an as-needed basis. The committee will likely include key National Agencies and potential implementation partners.

C. Phase I Project Objectives and Activities

The Makira Forest Project will be implemented in several phases. The initial phase will establish baseline information and pilot activities. The later phases will create and support long-term regional natural resource management and development structures.

Phase I project objectives include:

1) Market the carbon benefits to potential investors
2) Create and implement of a carbon baseline and monitoring program
3) Create a legally protected Conservation Area
4) Promote sustainable natural resource management through land-use planning and targeted development activities
5) Establish a management structure for the Conservation Area

At the end of the first phase, we expect the following specific outputs:
- Complete project financing for Phase I activities including carbon financing
- Baseline carbon data established
- Carbon and environmental monitoring program in place
- Completed biodiversity inventories for selected taxa
- Completed socioeconomic inventories
- Completed legislation for the creation of a Conservation Area at Makira
- Preliminary Zoning plan for Conservation Area
- Regional natural resource management plan
- Several local land-use plans in areas with high deforestation rates
- Pilot projects initiated with monitoring in place aimed at stabilizing land-use in high-pressure areas.
- Placement of an initial Conservation Area Management team

D. Specific Phase I Project Objectives

Phase I will run for approximately 2 years. The following activities are suggested:

- **Market the carbon benefits to potential investors**
  1. Prepare a full dossier of materials reflecting existing relevant information concerning the investment
  2. Set up and conduct meetings with potential investors
  3. Prepare a contract defining the transaction in collaboration with the GOM (MEF and other appropriate government actors)
  4. Negotiate and close investment deal

- **Creation and implementation of a complete carbon baseline and monitoring program**
  1. Determination of on-site baseline study and monitoring protocol
  2. Establishment of GIS database and remote sensing protocol (see annex 5)
  3. Establishment of permanent sample plots and generation of baseline data (see annex 2 and 3)
  4. Generation of baseline socioeconomic data
  5. Creation of model for predicting land-use changes and GHG emissions

- **Creation of a legally protected Conservation Area**
  1. Biodiversity Inventory of potential Conservation Area
  2. Determination and Preparation of Classification
  3. Promotion of government action

- **Promote sustainable natural resource management through land-use planning and targeted development activities**
  1. Creation of a regional natural resource management strategy and 10-year action plan
  2. Work with local decision-makers to establish local resource management plans

3. Identify and test targeted development activities at key locations to minimize leakage and to increase overall project success
4. Identify and support local development organizations

- **Establish Management Program for Conservation Area**
  1. Establishment of an initial Conservation Area management plan
  2. Create basic infrastructure for Area management
  3. Hire and train staff
  4. Establish communication program for local residents
  5. Facilitate legal enforcement through overflights and close partnerships with the MEF and other enforcement agencies

Figure 5. Timeline for main activities for Year 1 (Y1) and Year 2 (Y2) divided into 6-month periods.

Activity	Y1 A	Y1 B	Y2 A	Y2 B
Market the carbon benefits to potential investors				
Prepare a full dossier of materials reflecting existing relevant information concerning the investment				
Set up and conduct meetings with potential investors				
Prepare a contract defining the transaction in collaboration with the GOM (MEF and other appropriate government actors)				
Negotiate and close investment deal				
Create and implement a complete carbon monitoring program				
Determination of on site carbon monitoring protocol				
Establishment of GIS database and remote sensing protocol				
Establishment of permanent sample plots and generation of baseline data				
Generation of baseline socioeconomic data				
Creation of model for predicting land-use changes and GHG emissions				
Establishment of socioeconomic monitoring program				
Creation of a legally protected Conservation Area				
Biodiversity Inventory of potential Conservation Area				
Determination and preparation of classification				
Promotion of government action towards classification				
Promote sustainable natural resource management through land-use planning and targeted development activities				
Work with regional and local decision makers to create a regional natural resource management strategy and 10-year action plan				
Work with local decision-makers and communities to establish local resource management plans				
Identify and test targeted development activities at key locations to minimize leakage and to increase overall project success				
Identify and support local development organizations				

Establish Management Structure for Conservation Area				
Establishment of an preliminary Conservation Area management plan				
Create basic infrastructure for Conservation Area management				
Hire and train staff				
Establish communication program for local residents				
Facilitate legal enforcement through overflights and close partnerships with the MEF and other enforcement agencies				

E. Activity Details Proposed for Phase I

1. Market the carbon benefits to potential investors

a) Prepare a full dossier of materials reflecting existing relevant information concerning the investment

The full dossier will include the refined results of the existing studies, this report and proposal, a project prospectus outlining the exact nature of the proposed off-market transaction and any relevant updates as the project progresses.

b) Set up and conduct meetings with potential investors

Once the dossier is completed, meetings will be called with potential investors. Energy, automobile, and appliance companies will be targeted. Additional funding sources such as foundations and other donors will also be sought. Makira Forest Project and WCS representatives will conduct the presentations – the WCS support staff based in the US will assist to minimize travel costs for the project. MEF representation will only be needed once the investors come to Madagascar for a visit. Marketing the carbon benefits can be considered a transaction cost of the project and resultantly, costs should be minimized. The use of brokerage services could be considered as an alternative means of facilitating the marketing of the carbon benefits. Brokerage fees could run from 4% up to 10% of the total value of the deal.

c) Prepare a contract defining the transaction in collaboration with the GOM (MEF and other appropriate government actors)

Upon the identification of an interested investment partner, a draft contract should be prepared to assist the Project with contract negotiation. There are many issues that will be part of the negotiation and preparedness is essential for a successful deal. In the case of an on-market deal, there are two main elements that could complicate a transaction and these need to be discussed and translated into legal text. The first is ownership of carbon benefits: who is selling and who is guaranteeing the credits? The second is the use of proceeds:

how will the investment money be spent and who will provide the financial and operational accountability? These issues have been discussed above but will need to be written in legal terms and agreed upon by the parties on the selling side. These are only a few of the many issues involved in a market-based carbon contract. Preparation of a draft contract in advance will facilitate the identification and analysis of these issues prior to their actual negotiation with the client.

d) Negotiate and close investment deal

The negotiation and deal closure will require additional support from a lawyer experienced in complex long-term contracts. There are a few firms that are developing specialties in carbon and other environmental contracts. Part of the contract may include the purchase of an insurance instrument to protect the seller who is ultimately responsible for providing the carbon offsets promised. Insurance will not be necessary if the final deal is an off-market investment in carbon benefits.

2. Create and implement a complete carbon baseline and monitoring program

a) Determination of onsite carbon baseline study and monitoring protocol

The carbon monitoring protocol will guide all baseline and long-term monitoring activities. Although refinements will occur during the life of the project, it is essential to plan and cost the monitoring project in advance. The protocol will reflect the eventual potential for certification of carbon credits within the framework of the Kyoto protocol's CDM. Since the first commitment period excludes avoided deforestation from Certified Emission Reduction (CER) credit, the project's program will follow the norms for Land-use, Land-use Change and Forestry (LULUCF) projects accepted in the developed countries (Kyoto Protocol Annex I countries). It will be assumed that the norms used for certifying Annex I projects will apply to CDM projects during subsequent commitment periods. The protocol will include the following carbon pools:

1) Above-ground woody biomass
2) Understory biomass
3) Below-ground biomass (roots)
4) Litter and
5) Soils.

The protocol will include both ground surveys and use of remote sensing.

b) Establishment of baseline scenario using GIS and remote sensing

The preliminary work conducted by PAGE with assistance from BIODEV will be continued and refined. The remote sensing baseline will provide two principle functions: 1) Identification of areas needing conservation or development actions and 2) monitoring land-use patterns for changes against baseline and projections. All activities of the project will be conducted with the assistance of GPS and GIS. The land-use maps will also be used for working with regional and local stakeholders during land and natural resource use planning. The use of aerial photography or videography will be considered depending on the level of forest type segregation possible from a combination of satellite image treatment and associated ground-truthing. There will be very close coordination between the remote sensing / mapping work and 1) the biodiversity inventory, 2) the socio-economic study, 3) the carbon monitoring program and 4) the development – anti-leakage projects. Proposed methods for carbon monitoring by remote sensing are provided in annex 5.

c) Establishment of permanent sample plots and generation of baseline data

Based on a comparative study in the Noel Kempff Climate Action Project[10], we have decided to use 100 permanent sampling plots across the entire zone. A description of the sampling methodology is presented in annex 3. The approach presented in annex 3 will be modified very early in Phase I after a preliminary walkthrough of the Makira Area. We estimate the initial establishment of the 100 plots will cost approximately $56 thousand in direct costs with an additional $50 thousand in fixed and additional costs for organizational, technical and logistical support (these are costs not attributable to specific plots but must be spent to prepare and support the field work.) An additional $25 thousand will be needed for data analysis and reporting. The total cost of establishing permanent plots will be on the order of $131,000.

More detail about a potential sampling method is provided in annex 2 and 3 but the actual project will likely include much less preparatory work and fewer plots than is currently described in the annexes.

d) Generation of baseline socioeconomic data

Baseline socioeconomic data is required for three main purposes: 1) establishment of the baseline conditions and projection for determining the carbon benefits of the project and 2) to identify potentially viable development projects to contain leakage and facilitate project success and 3) classification study. Baseline socioeconomic data will be collected by a team led by a

[10] Boscolo, M., M. Powell, M. Delaney, S. Brown, R. Faris, "The Cost of Inventorying and Monitoring Carbon: lessons from the Noel Kempff Climate Action Project." Journal of Forestry, Vol. 98, No. 9, September 2000. p 24-31.

socioeconomist but also potentially including an agronomist or a forester. The overall plan involves identifying the location of all villages and hamlets, generating baseline information for as many as possible, then performing more detailed socioeconomic inquiries in selected locations. This study will also serve to open initial dialogues with local villagers on NRM in general. Over the course of the two years of project activities, the team will visit a relatively complete sampling of villages and hamlets throughout the Project Study Zone.

The members of the socioeconomic baseline team will take part in the initial inventories of targeted areas and they will also play a role in consultations concerning the potential zoning of the region.

e) Creation of model for predicting land-use changes and GHG emissions

The model is essential for the calculation of baseline carbon emissions. The model used in this project will be based on the existing models (e.g. LUCF) and will be adapted for use in this area. The project may also use a land-use planning model and software tool that has been developed for regional forestry and conservation planning. This tool allows planners to "observe" the impact of their management choices on the evolution of the regional forests.

f) Establishment of socioeconomic monitoring program

Following the analysis of the socioeconomic data, a monitoring program will be established. The goals of the program will be to simultaneously monitor the effectiveness of the project activities related to their objectives and to monitor the impact of the project itself against the baseline predictions.

3. Creation of a legally protected Conservation Area

a) Biodiversity Inventory of potential Conservation Area

Biodiversity inventories of the potential Conservation Area will include studies of the flora and fauna as well as general habitat analysis.

Flora – the floral studies will emphasize the diversity found in the unusual bioclimatic zones (see annex 6), as well as examining the importance of the unusual geological intrusions and other formations in the area. Two researchers working full time for two years will seek to establish and inventory a total of 36 plots divided evenly among 9 habitat types. Slight changes to these numbers can be expected following better determination of habitat types in the forests. These plots may coincide with some of the carbon monitoring plots to benefit from technical expertise and logistics. More details of the proposed floral inventories are presented in the Floral Report (annex 6)

Fauna – the faunal inventories will attempt to cover most of the groups that remain underrepresented in previous studies. These include:
Primates
Carnivores
Small Mammals (rodents and tenrecs)
Birds
Reptiles and Amphibians
Fish* and
Arthropods*

* depending on researcher availability

It is suggested that the Faunal inventory be conducted as a team effort with all researchers collaborating on the determination of the specific location of field sites and, to the extent feasible, with communal logistics. All attempts will be made to induce researchers to participate in the inventories on a voluntary basis with logistical support from the project. This will minimize the cost and assure high quality data. It will be necessary to engage a team leader to prepare logistics and verify adequate coordination. The current proposition is six field sites with three in lower altitude and three in higher altitude; three south of the Antainambalana and three north of the river. Most groups will only be studied at a total of four sites. Only primates and birds will be studied at all six sites (unless outside funding is provided). Each site will be visited for 10 days of sampling with one or two set up days on either end.

Habitat analysis – the habitat analysis will be conducted as a joint project with the faunal inventories and the carbon baseline study. Ideally, the end goal of the habitat analysis will be to identify forest types that can be monitored via satellite imagery. One or two ecologists accompanying the faunal team and the carbon baseline study team will conduct the habitat analysis. A GIS specialist will work with the ecologists to conduct ground-truthing of different forest types. This will improve the quality of the vegetation cover maps and facilitate monitoring land-use change and carbon benefits.

b) Determination and preparation of classification

Based on the results of the biodiversity inventories, improved vegetation and habitat maps, and the socioeconomic indicators, a proposition will be prepared for the limits a new Conservation Area and perhaps a Sustainable Natural Resource Management Area. The use of multiple management zones is recommended to allow controlled use zones as well as pure conservation / protection zones.

The classification status of the Conservation Area will be discussed with the MEF, ANGAP and other national and international groups. The goal of determining the classification status will be to explore new options for adapting the IUCN protected area classification scheme to the needs of ANGAP, MEF and the autonomous provinces.

The legislation for the classification will be prepared with the results of the two previous tasks.

c) Promotion of government action towards classification

The project will assist the MEF and/or ANGAP with marketing of the proposal to the appropriate government authorities to facilitate its approval at local, regional and national levels.

4. Promote sustainable natural resource management through land-use planning and targeted development activities

a) Work with regional and local decision makers to create a regional natural resource management strategy and 10-year action plan

One main element of the zoning plan for the Conservation Area and the surrounding landscape will be the establishment of a regional natural resource management strategy. The strategy will include spatial analysis and an inventory of local resource opportunities. The establishment of the strategy will require a strong participative approach working at multiple levels of civil society, public organizations, and with private sector actors. The strategy will build on the existing programs of regional and community development planning. Ideally the strategy will simply be a part of the existing regional development plans and strategies. The project will focus on the promotion of the ideas of sustainability and provide technical support for natural resource management issues.

b) Work with local decision-makers and communities to establish local resource management plans

The local development planning process ("Plan de Développement Communautaire" PDC) will be assisted with technical support to enhance the inclusion of sustainable natural resource management and land-use planning. The assistance provided by the project will be limited to target villages and communes. The choice of participating villages will be made together with the regional governments and will depend upon both the location of the villages with regard to levels of deforestation as well as relative advancement with the planning. The potential use of conservation contracts and other forms of performance payments will be explored.

c) Identify and test targeted development activities at key locations to minimize leakage and to increase overall project success

This activity, as well as some of the activities described above, will be conducted in partnership with an organization that specializes in rural development activities: agriculture, agroforestry, and natural forest management. Multiple organizations may be involved and no decisions have been made at present concerning partner organizations. All attempts will be made to work with and promote existing development players in the region. When possible, development activities will be implemented by local development partners. Alternative sources of funding for development activities will be sought to leverage the project's financing.

The specific choice of activities will be made early in Phase I following an initial assessment and identification of target sites. Activities promoted by the project will be aimed primarily at reducing deforestation and stabilizing land use. It is likely that the project will begin activities by providing assistance with vanilla and cloves since these products have recently had strong market values and are of direct interest to the population. Innovative partnership models will be explored to increase local buy-in to long-term sustainability objectives.

Below is a list of some potential activities. Details will be established during the course of the first 6 months of project studies and discussions.

- Promote improved irrigated rice
  - Goal : Reduce pressure on land; drive local economy; create opportunities to stabilize land occupation.
  - How : Identify paddy rice land-tenure patterns and processes; identify market and technical shortcomings; design technical mitigation activities with existing actors; promote fund-raising activities for technical assistance; explore possibilities for variety improvements for production improvements and also in light of negative methane emissions

- Enhance market access
  - Goal : Increase accessibility to regional and national markets
  - How : Identify the logistic bottlenecks; Develop local initiatives for community road creation and maintenance; lobby for road building initiatives if wanted by local communities

- Promote agroforestry (vanilla, cloves, coffee)
  - Goal : Increase revenues with cash crops; stabilize land tenure; minimize unwanted exploitation of producers by intermediate businesses
  - How : Examine traditional agroforestry systems; identify biological and socioeconomic bottlenecks and analyze why they persist; provide training and improved varieties, diversify products if desired; explore means to enhance production w/ technical assistance

- Community and individual forestry
  - Goal : enhance the value of standing forests to the local community; identify mechanisms to secure long-term maintenance of the forest estate; assess

risks and propose risk-mitigation activities, examine the market opportunities for local forest products.
  - How : Investigate existing models for community forestry being implemented elsewhere in the country (e.g. CAF) and conduct local tests; follow the recently produced guide for transfer of management rights of forests to the communities; evaluate the risks in promoting forest activities and the levels of success; explore alternatives for forest maintenance if the "use it or loose it" model does not appear to be effective.

- Managed forest succession
  - Goal : Restore forest habitats from low-density agricultural systems (frontier "*Tavy*")
  - How : Explore the biological and socioeconomic bottlenecks of forest succession enhancement; investigate leakage issues in case of local acceptance; explore carbon offset mechanisms to finance restoration through natural successions

d) Identify and support local development organizations

The Project seeks to increase the local capacity for various economic development activities in the region. As such, it will support both private sector and NGO initiatives and organizations seeking to promote sustainable forms of economic development in the region. At present there are very few such organizations in Maroantsetra and even fewer in the Project Study Zone.

5. Establish Management Structure for the Conservation Area

This entire task will be conducted only during the final 6 months of Phase I or during the early part of Phase II.

a) Establishment of a preliminary Conservation Area management plan

The Zoning plan that will be established for the Project Study Zone will include basic zoning recommendations for the Conservation Area. A preliminary management plan will be written for the Area with the aim of guiding initial activities during the first few years of operation. Its primary goal will be to program basic management activities such as marking limits, establishing enforcement programs, developing a communication strategy for local and regional inhabitants, and will include such items as staff training requirements and operational budgets.

b) Create basic infrastructure for Conservation Area management

The basic infrastructure for the Conservation Area management will include a management office, basic computer equipment, communications, and administration needs.

c) Hire and train staff

Initial Conservation Area management staff will be hired. Personnel will most likely include a reserve manager and several reserve "guards"

d) Establish communication program for local residents

One important initial task of the management will be to communicate with the local residents about the objectives and benefits of the Core Conservation Area and how its creation will affect those residents. Effective communication will be essential during the public discussions on the establishment of limits and different use zones.

e) Facilitate legal enforcement through overflights and close partnerships with the MEF and other enforcement agencies

A strong partnership with local enforcement agents of the police and local government will be established. A program of legal enforcement will be planned with the local MEF agents and local governments.

VIII. Preliminary Project Budget

The following budget should be considered preliminary. Many figures are reduced from the proposals and budgets contained in the appendices as synergy between different project components allow cost efficiencies. Further cost efficiencies are possible by combining activities and using full time staff as opposed to consultants. A more detailed budget can be made available upon request.

ACTIVITY	Total Costs $
Market the carbon benefits to potential investors	
Prepare a full dossier of materials reflecting existing relevant information concerning the investment	7,050
Set up and conduct meetings with potential investors	8,400
Prepare a contract defining the transaction in collaboration with the GOM (MEF and other appropriate government actors)	12,600
Negotiate and close investment deal	5,040
SUBTOTAL MARKET CARBON	33,090

Create and implement a complete carbon baseline and monitoring program	
Determination of on-site carbon baseline study and monitoring protocol	33,140
Establishment of GIS database and remote sensing protocol	15,000
Establishment of permanent sample plots and generation of baseline data	131,200
Generation of baseline socioeconomic data	31,648
Creation of model for predicting land-use and GHG changes	750
Establishment of monitoring program	1,500
SUBTOTAL CARBON MONITORING	213,238

Creation of a legally protected Conservation Area	
Biodiversity Inventory of potential Conservation Area	227,770
Determination and preparation of classification	21,120
Promotion of government action towards classification	9,000
SUBTOTAL CONSERVATION AREA CREATION	257,890

Promote sustainable natural resource management through land-use planning and targeted development activities	
Work with regional and local decision makers to create a regional natural resource management strategy and 10-year action plan	13,050
Work with local decision-makers and communities to establish local resource management plans	26,450
Identify and test targeted development activities at key locations to minimize leakage and to increase overall project success	130,400
Identify and support local development organizations	15,000
SUBTOTAL SUSTAINABLE NRM	184,900

Establish Management Structure for Conservation Area	
Establishment of an preliminary Conservation Area management plan	3,000
Create basic infrastructure for Conservation Area management	38,800
Hire and train staff	5,000
Establish communication program for local residents	2,000
Facilitate legal enforcement	4,000
SUBTOTAL MANAGEMENT STRUCTURE	52,800

Subtotal Cost of Entire Project	741,918
Program Administration	148,384
Technical Advisor	70,000

TOTAL PROJECT COST	960,302

IX. Photos of the region

The technical work on this project to date included two over flights of the region of the Makira forest project. The participants in the over flight took photographs from the plane throughout the flights. The photos provide a snapshot of the state of the forests and land use both in the Makira Forest Project zone as well as in the regions bordering it to the east as far as the Masoala National Park. The over flights had a strong influence on the selection of the Makira Project area and are an important source of information for the next stages of the project. The complete collection of photos has been made available to the Ministry of Water and Forests in printed form as well as in digital form on CD-ROM. The CD-ROM includes a map showing the over flight paths. By clicking on the numbers on the map, one can see the photograph that corresponds with that location on the map.

X. Annexes

1. Forest Cover Change between 1990 and 1996, Clarck BIODEV 2001a " Projet Pilote de Captage de Carbone: Analyse de l'evolution de la couverture forestiere entre 1990 et 1996"

2. Biomass Estimation Summary, Pierre Berner 2001.

3. Biomass Estimation, Joël Ndriatsimaniry Rakotomaro 2001a. "Estimation de la biomasse de reference pour le project de piegeage et de conservation du corridor de Makira-Anjanahariba-Sud."

4. Carbon Monitoring, Pierre Berner and Joel Rakotomaro 2001a. "Makira forest conservation-based carbon-offset project. Biomass part II: Methodological guidelines for estimating and monitoring carbon storage"

5. Monitoring Land-use Change, Clarck BIODEV 2001b "Projet pilote de sequestration de carbone methodologies de monitoring des pertes des couvertures forestieres"

6. Floral Biodiversity in the Makira Area, Missouri Botanical Garden, Madagascar 2001

7. Faunal Biodiversity in the Makira Area, ZICOMA, Madagascar 2001